global balance

an LHC perspective

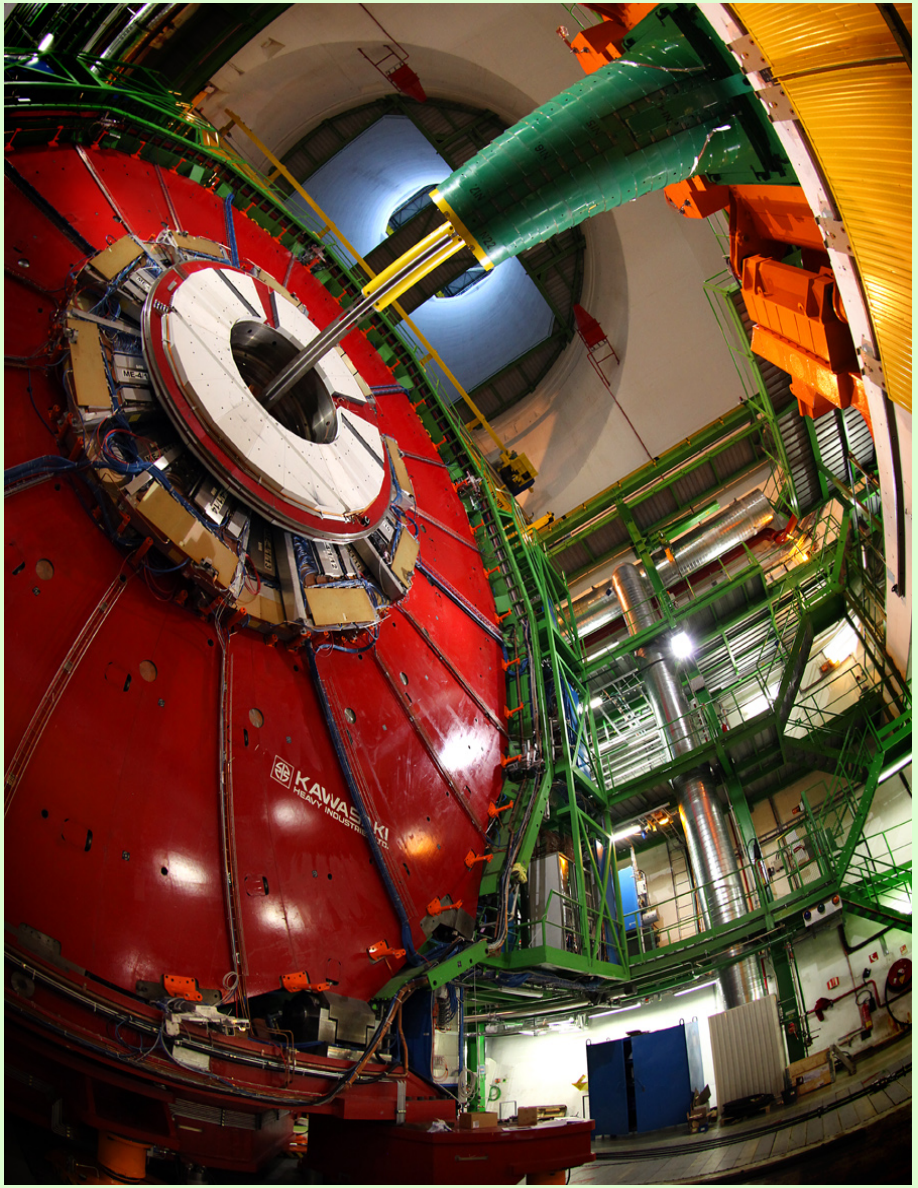
June 2013 - photo by
Michael.Hoch@CERN.ch

Snowmass, MN
August 3, 2013

Joe Incandela

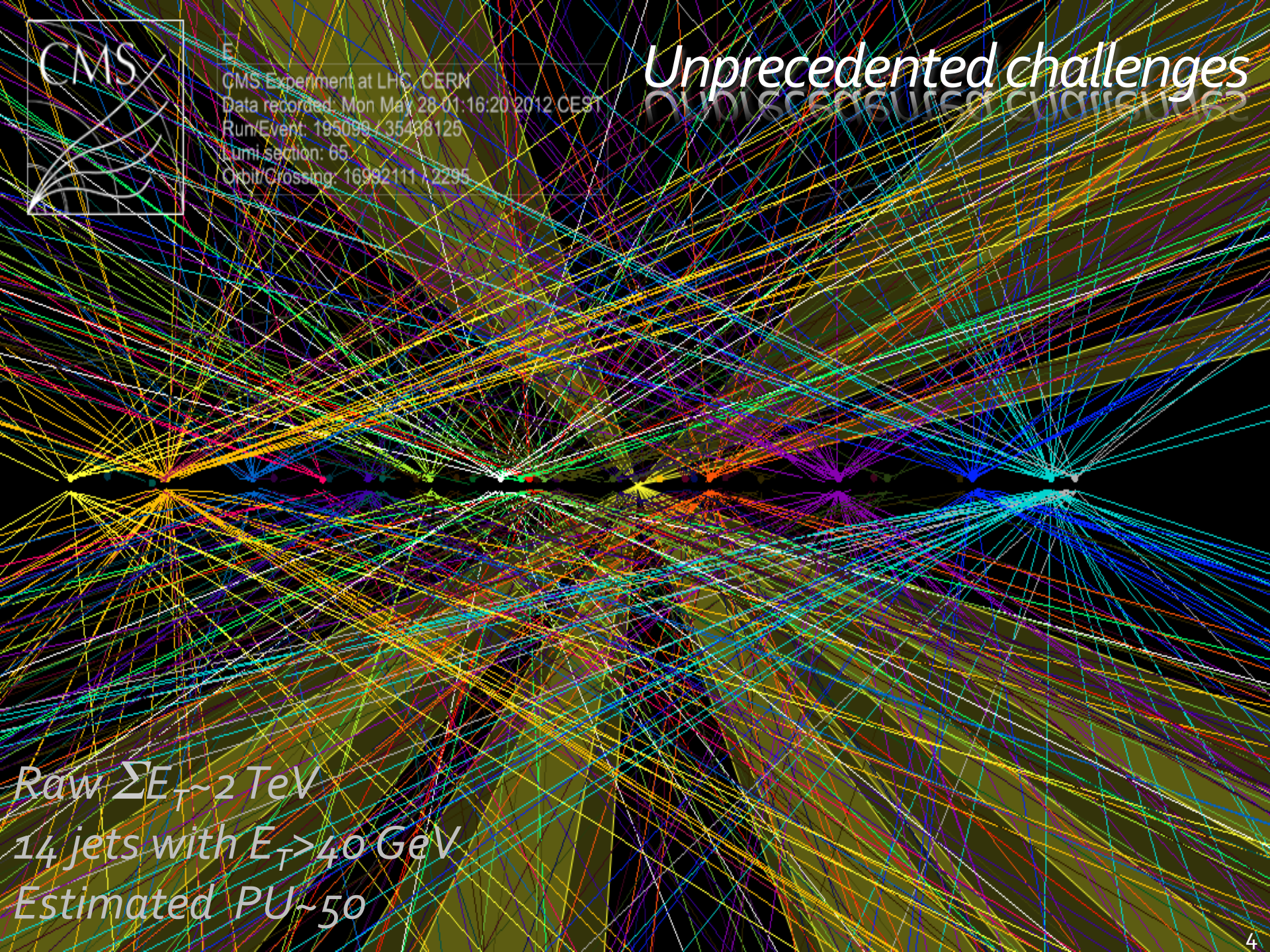
What follows an historic discovery?

- LHC Run 1 a success
- Runs 2-3 and the HL-LHC at 13-14 TeV will extend the search
  - This is the energy frontier for the foreseeable future
    - Fully exploit it
      - A huge potential could go untapped if it is undercut
    - The US is by now a well established collaborator
  - Most of all, important physics is guaranteed



post- H(126)-discovery

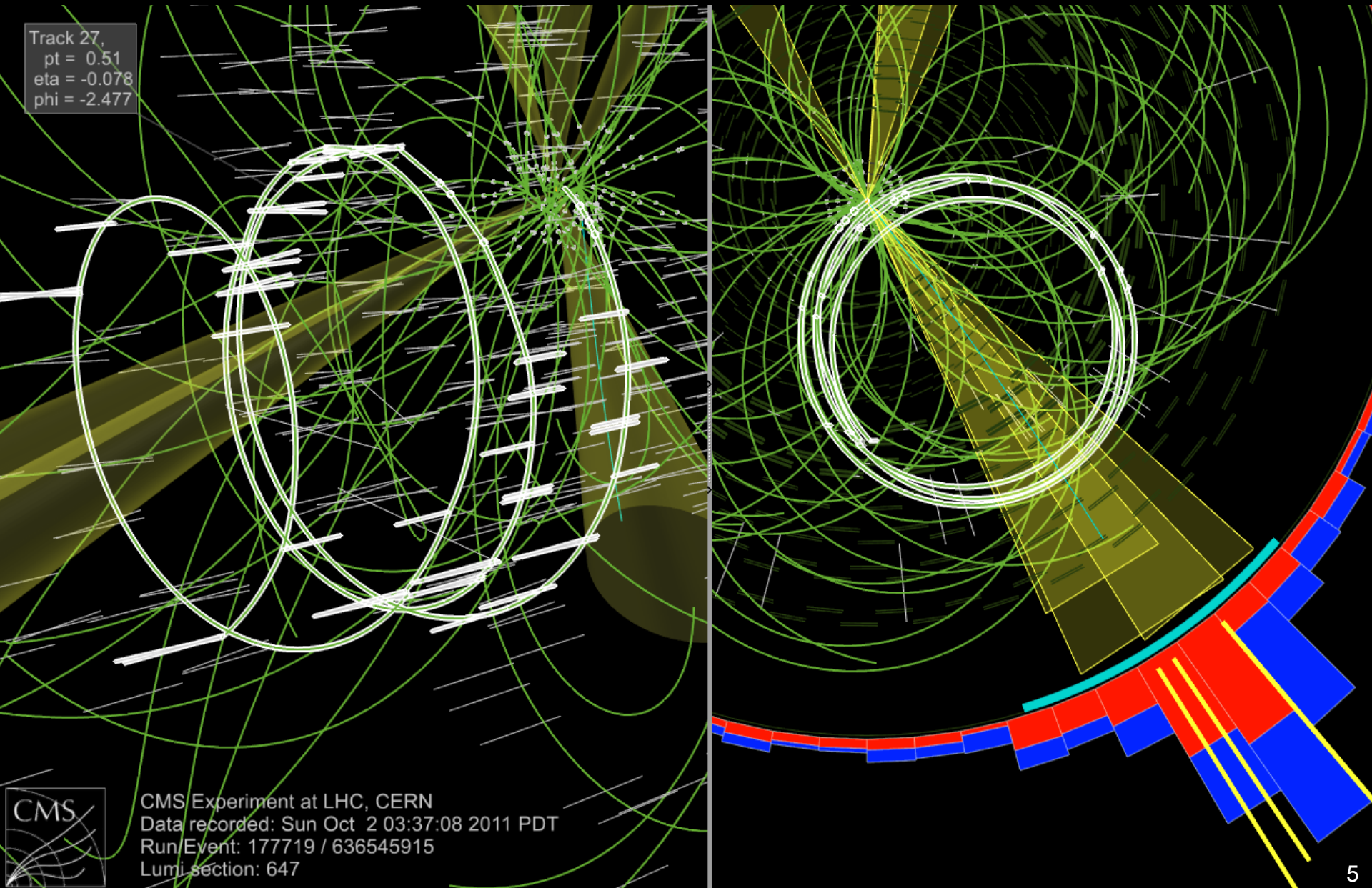
- There are reasons to believe it will not be the last at the LHC
  - We have really just begun the searches
  - A lot of parameter space yet to be accessed …
    - *E.g. see EPS plenary talk of O. Buchmueller*
  - And many *yet-to-be* models will go untested without an active broad-band hadron collider
- Investment is critical
  - More powerful detectors, triggers, computing.. will bring a sustained period of important results
  - Also in accelerator R&D that could be a big part of US national labs program
- The LHC can also do precision and rare physics, looking for particles beyond its direct production reach
  - A superb intensity frontier machine
- It's the only Higgs, (top, Z, W…) factory on the planet for many years to come!



Unprecedented challenges

Raw ΣE_T~2 TeV
14 jets with E_T>40 GeV
Estimated PU~50

Unprecedented capabilities



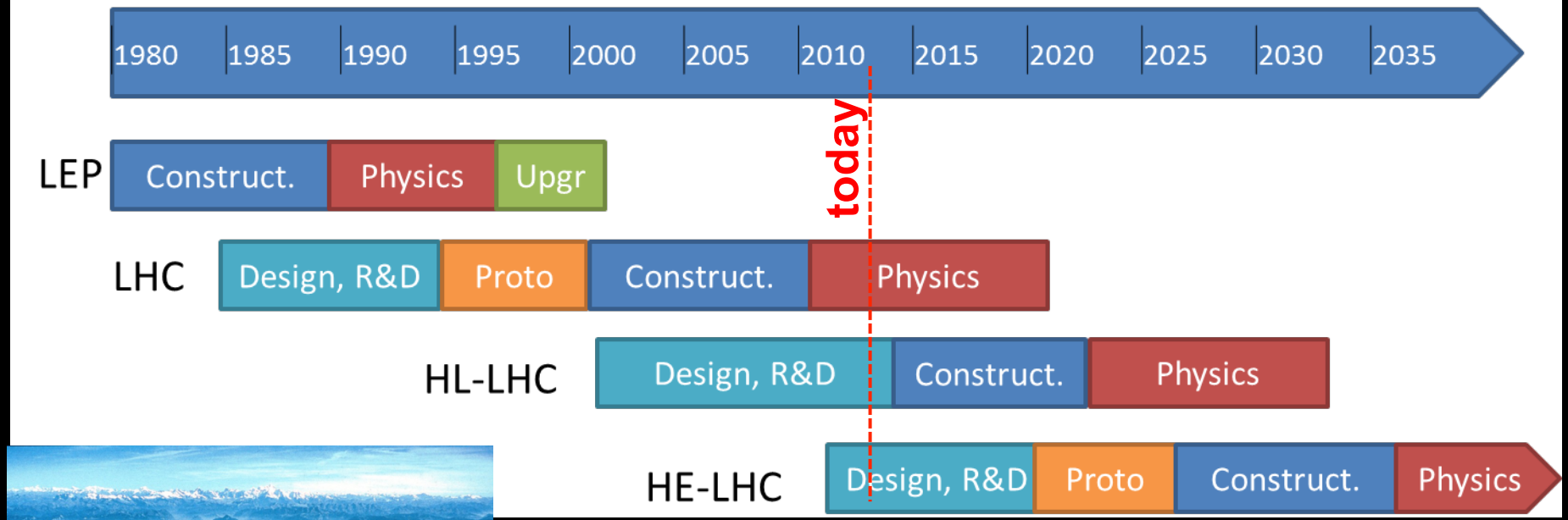
Unprecedented impact

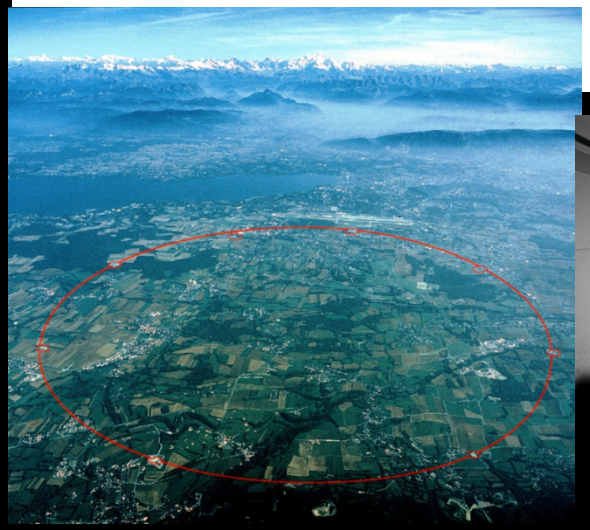
17,000
news articles in
108
countries in
2
days

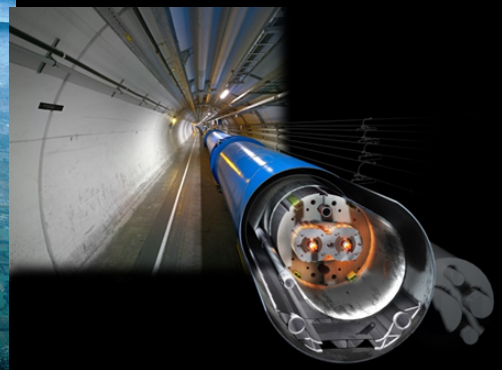
> 1 billion
people saw TV footage
1,034
TV stations
5,016
Broadcasts

Unprecedented potential

The super-exploitation of the CERN complex:
Injectors, LEP/LHC tunnel, infrastructures

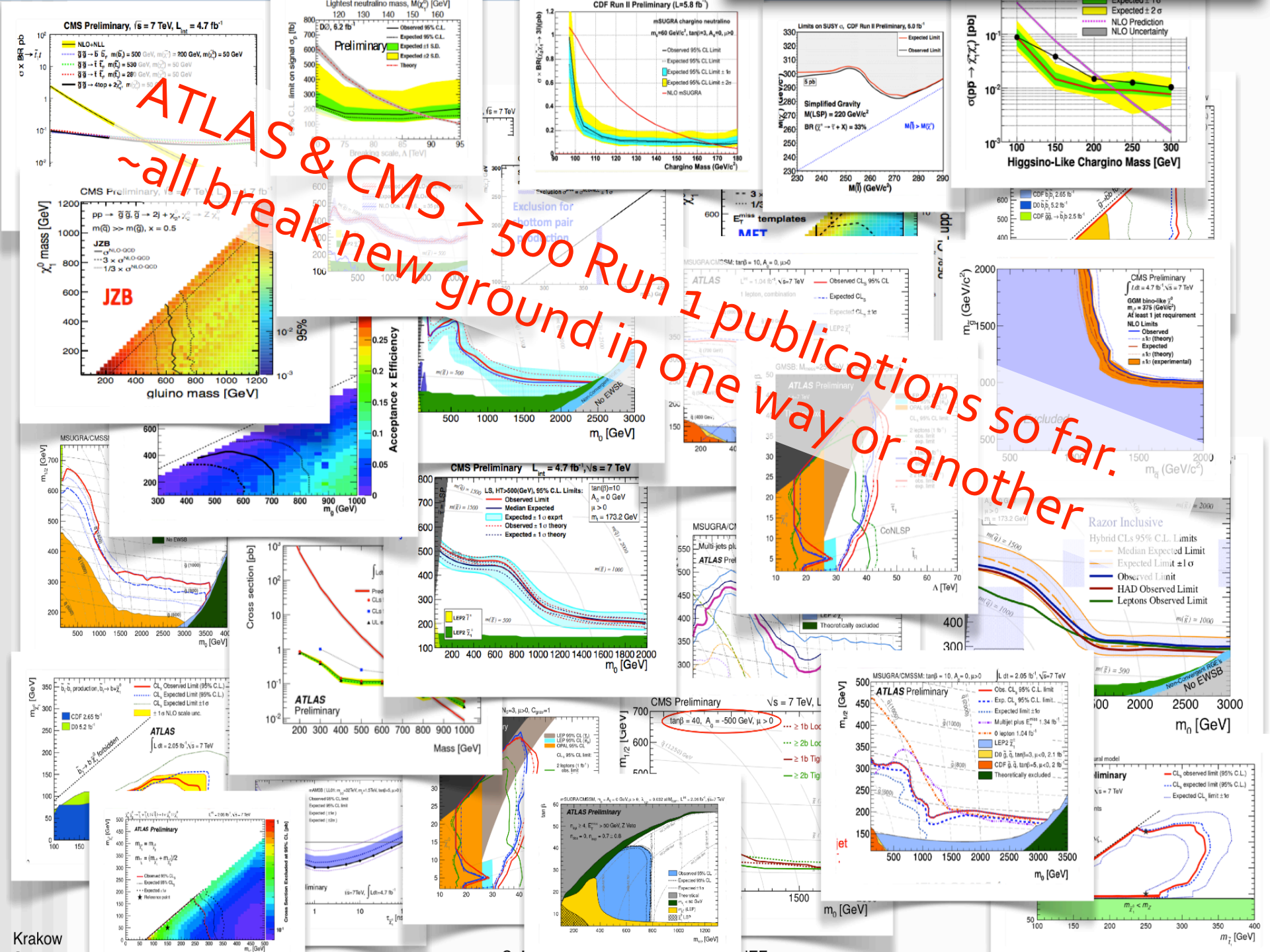






2000 large magnets of 15-20 T
1500 tons of HEP grade Nb3Sn
500 tons of HTS for magnets
100 tons of SC for Sc links

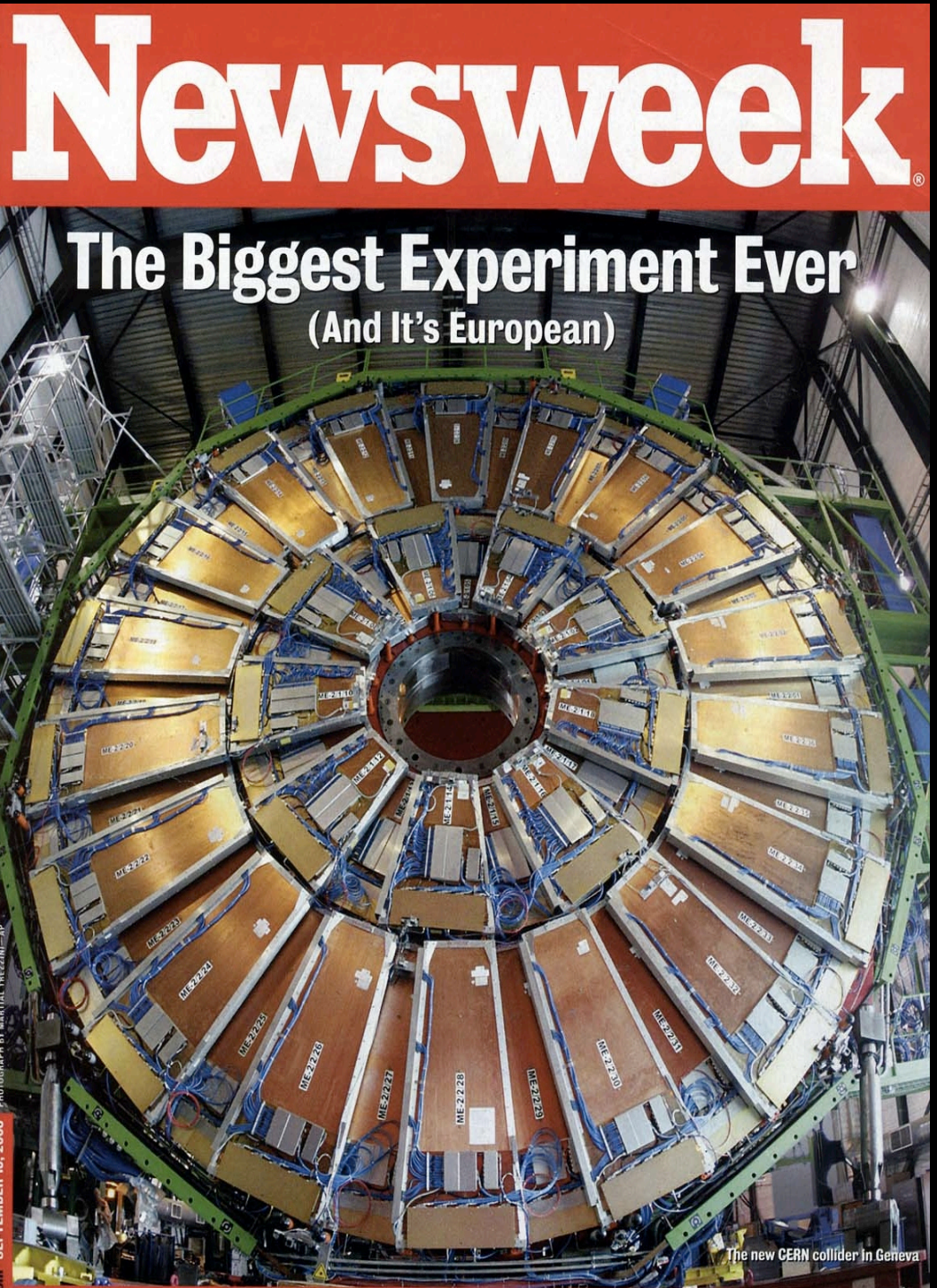
Courtesy L. Rossi


ATLAS & CMS > 500 Run 1 publications so far.
~all break new ground in one way or another

Krakow

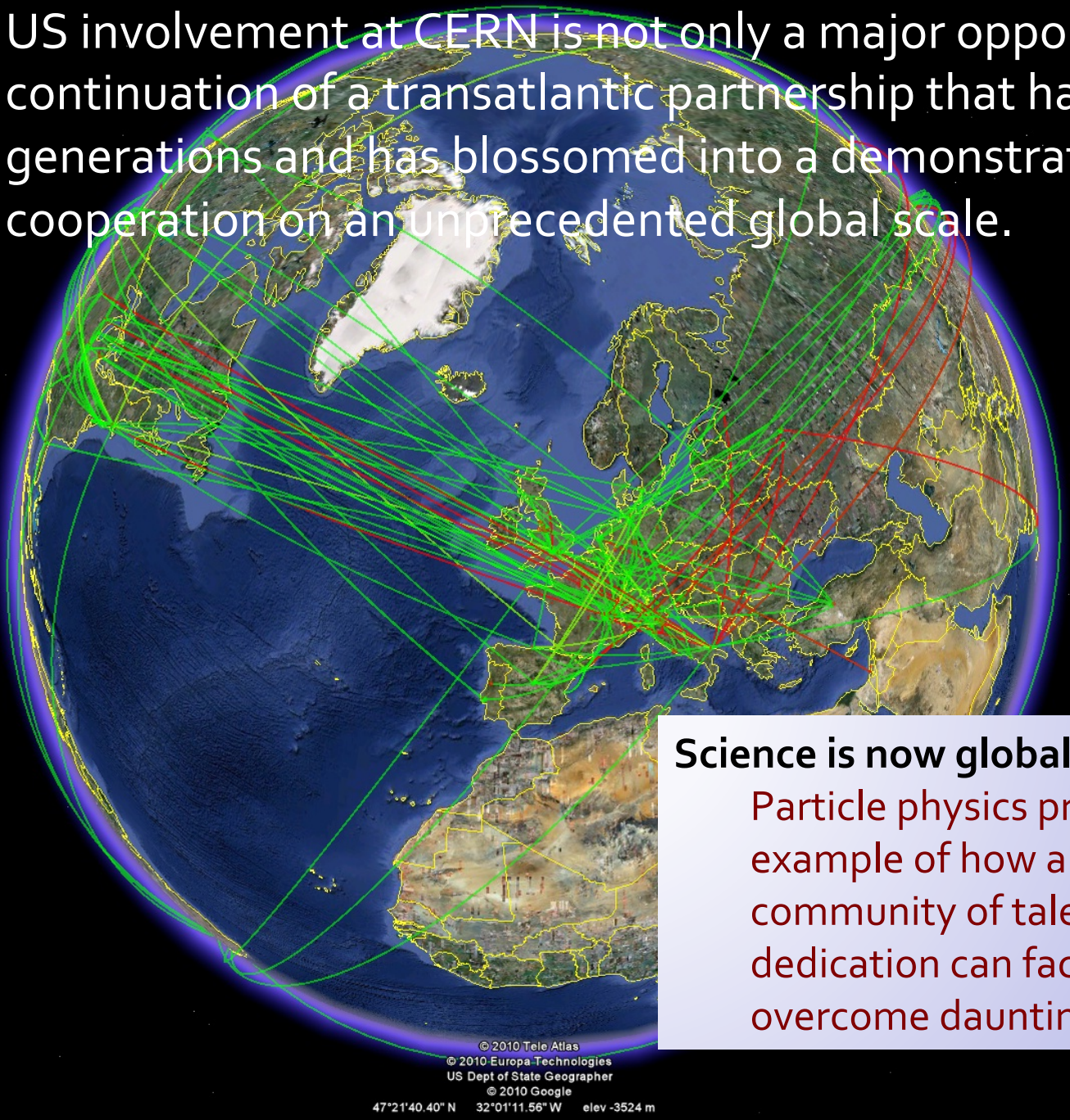
The LHC

A global and US success story



- And yet the view persists that the LHC is not a US program!
  - Out of scores of countries, the US has made some of the largest contributions to the detectors
- ~25% of CMS+ATLAS
  - Most of what you see here was made in the USA
  - Also contributed a smaller amount to ALICE
- Key contributions to LHC accelerator complex
  - And vital R&D with LARP
- THANKS to DOE and NSF
  - and so many US labs & Universities for their support!

US involvement at CERN is not only a major opportunity, it is the continuation of a transatlantic partnership that has spanned generations and has blossomed into a demonstration of peaceful cooperation on an unprecedented global scale.



Science is now global

Particle physics provides an example of how a global community of talent and dedication can face and overcome daunting challenges.

The next stage of the transatlantic partnership

- CERN welcomes strong US participation
  - In accelerators and detectors, the US involvement is extremely important.
- The US research community benefits tremendously
  - Retaining the ability to do cutting edge detector systems development and data analysis
- CERN understands the importance of the US LBNE project to the US and to overall global balance
  - A willingness to reciprocate

Global balance

- Host laboratories bear the lion's share of the infrastructure costs
- Leading regions need to share this burden
  - An example of a program of new initiatives for next N years:
    - EU: HL-LHC ++
    - US: LBNE ++
    - Japan: ILC ++
  - All 3 regions would support all 3 projects and encourage/ support participation of all other regions
    - The "Big 3" projects should not however preclude smaller projects that target important physics at *relatively small cost*.
- The US should remain a strong player
  - Now is not the time for the US to walk away from nearly century-long partnerships that have yielded part of the greatest scientific legacy in human history

A magnificent century (and counting…)

- From early radiation and cosmic ray experiments to accelerator-based, space-based and deep underground experiments…
  - Particle physics has advanced human understanding of the universe - it's underlying code, structure and evolution – by an incredible amount.
- The 'Standard Models' are among man's greatest achievements … ever … and will forever be part of our greatest legacy
  - And the story is not over.

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  - And the story is not over.
    - In fact it's 95% incomplete.

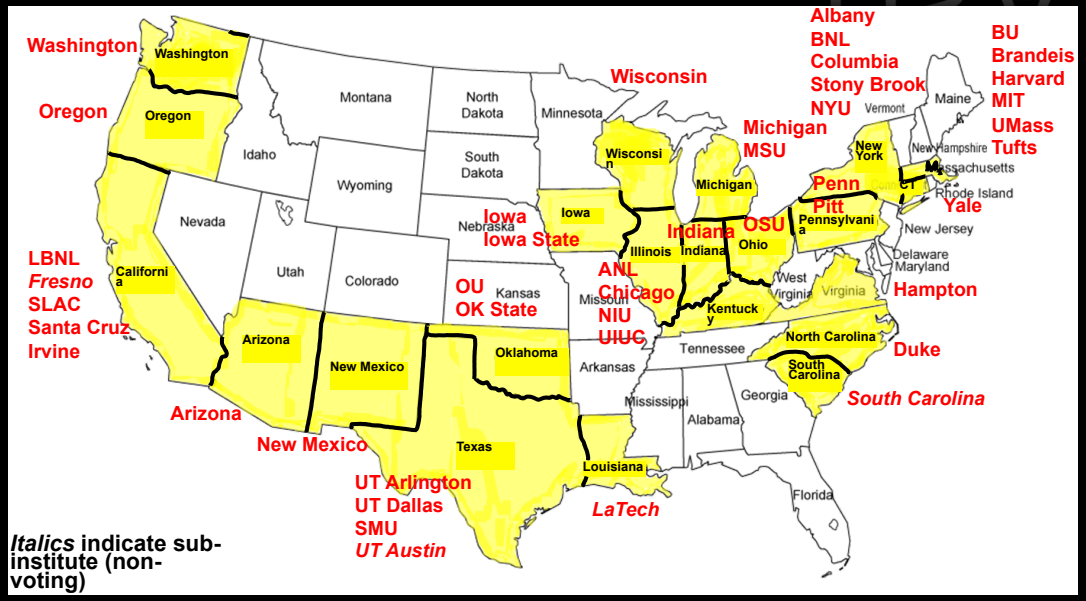
Additional slides

- ATLAS
  - 38 Countries
  - 176 Institutions
  - 3000 Authors total
  - 900 Graduate Students

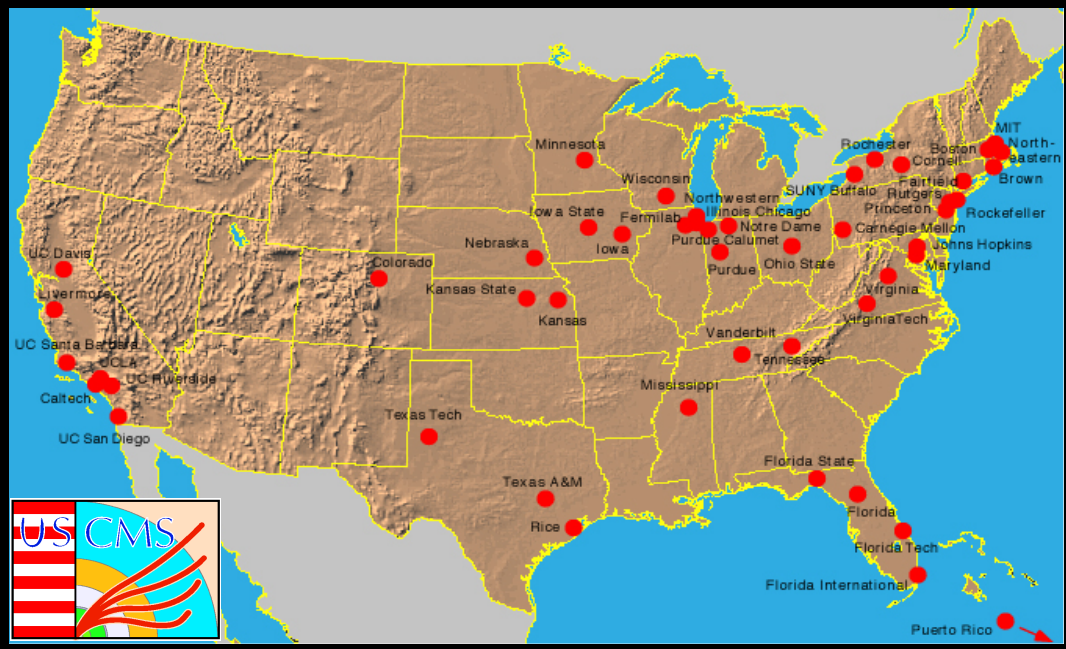
A small fraction of those who made CMS possible

CMS has ~4300 Scientists (including 800 PhD students), Engineers and technicians from 41 Countries and 190 institutes

US ATLAS, US CMS

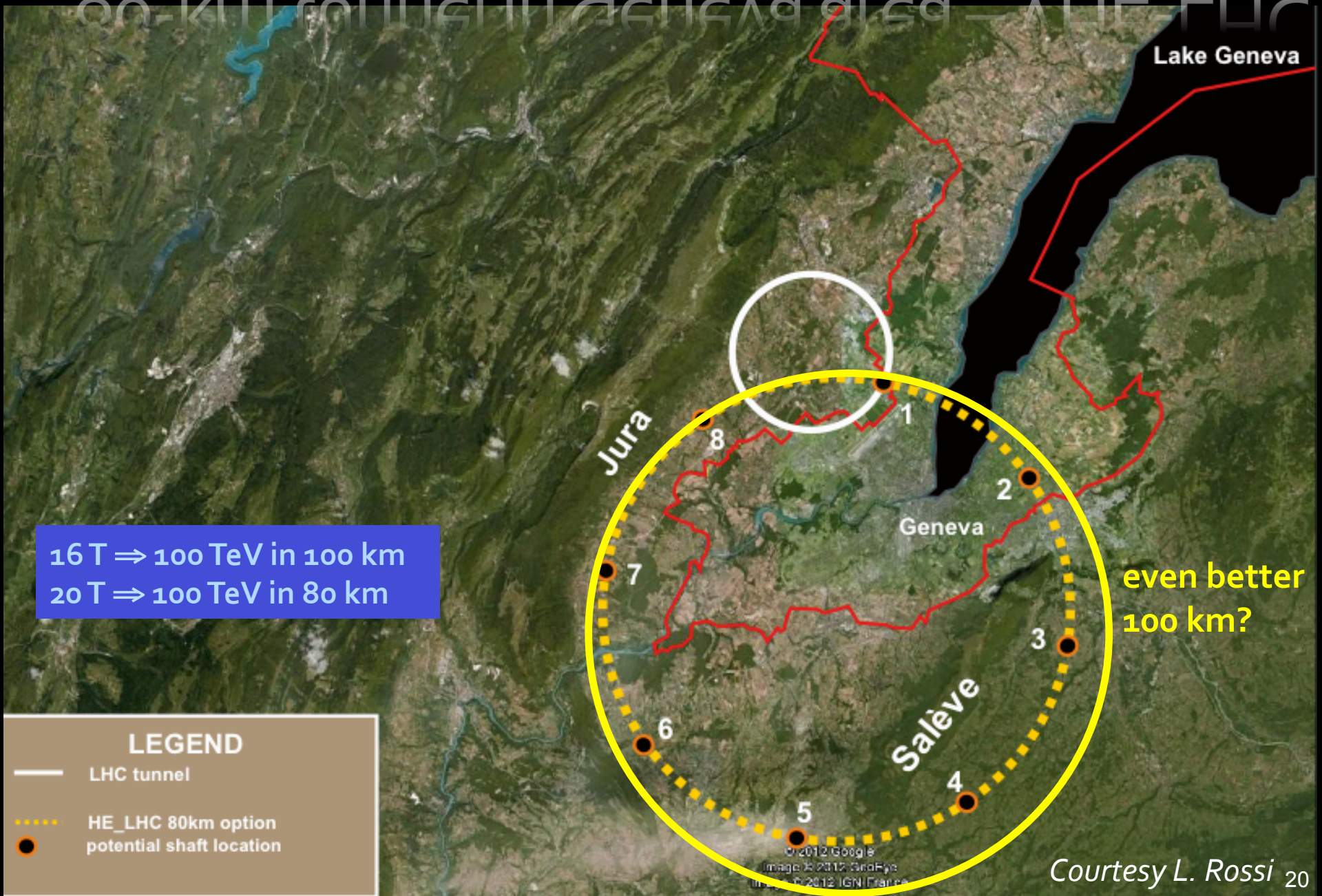


44 Institutions
600 Scientific Authors
170 Graduate Students



48 institutions
650 Scientific Authors
200 Graduate students

80-km tunnel in Geneva area – VHE-LHC



Courtesy L. Rossi

Where do we stand now?

The Higgs:
so simple yet so unnatural

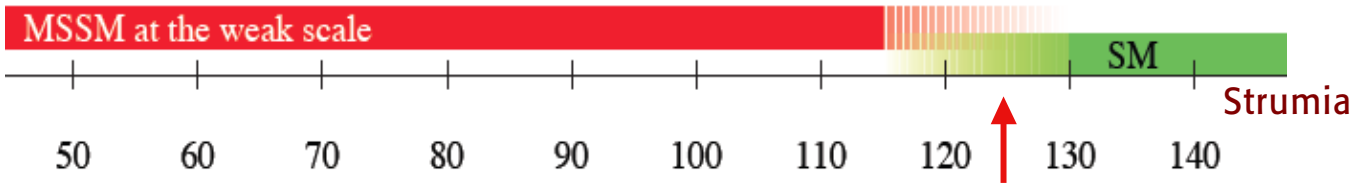
Guido Altarelli

Presentations/discussions *(Nobel Symposium, May 12-17 Uppsala)*

*Talk by G. Altarelli**

A malicious choice!

$m_H = 125.6 \pm 0.4$ GeV



*G. Altarelli: https://indico.cern.ch/conferenceDisplay.py?confId=239571